Hybrid organic inorganic membranes for PEMFC application

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For several years, the LCMCP has been investigating hybrid materials based on the use of sol-gel methods. This synthetic approach enables us to prepare materials which incorporate a wide variety of organic and inorganic compounds and are capable of developing unique microstructures and properties. Recently, we use this method to create ***electrochemical materials with designed chemistry and microstructure.***

One of our research direction is to design and develop low-cost and durable hybrid electrolyte membranes for fuel cell operating at high temperature (up to 120°C) and low humidity (RH) (25–50% RH). We have developed a "sol-gel strategy" for the production of hybrid membranes where the organic and inorganic components meet the requirements of high temperature operation. The hybrid membranes are composed of a bicontinuous networks of a thermostable polymer ensuring mechanical strenghtness, chemical inertness and hydrogen permeability and of 3-D mesostructured SiO_2-based network which supports proton conductivity and water retention. The benefit of using mesostructured inorganic network is an enhanced surface area which can accommodate the proton conducting functional groups ($–SO_3H$ and/or $PO(OH)_2$) together with facilitated transport property for proton. Proton conductivity will be explored over a range of humidities at 120°C. Finally, fuel cell testing will also be discussed for membrane/structure optimization.

References

1. O. Sel, C. Laberty-Robert, T. Azais, C. Sanchez, Phys. *Chem. Chem. Phys.* **2009**, *11*, 3733.

2. O. Sel, A. Soulès, B. Améduri, B. Boutevin, C. Laberty-Robert, G. Gebel, C. Sanchez, *Advanced Functional Materials* **2010**, *20*, 1090.

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